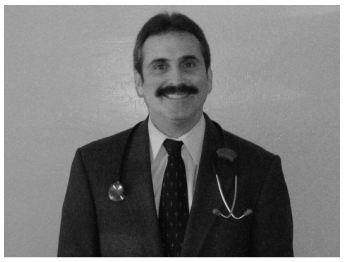
The Human component in General Aviation Accidents



David Bryman, D.O
Senior Aviation Medical Examiner
FAA, Transport Canada, JAA

All pilots are familiar with the term "Human Factors". We have heard this term many times in reference to NTSB reports when discussing the cause of an aircraft accident.

Although the flying machine may fail us occasionally, it is the human component that is the cause of aviation accidents more than 70% of the time. I'm not referring to aeromedical factors which involve a medical condition that leads to a sudden pilot incapacitation, such as stroke, heart attack, seizures, and so on. Fortunately, these account for less than 3% of accidents.

The human factors I'm referring to include more common conditions, many of which are "self-induced", such as: Fatigue, hypoglycemia, illness, noise, hypoxia, dehydration, vibration, visual illusions, jet lag, disorientation, alcohol, smoking, and self medication (to name only a few). These conditions make the pilot function less efficiently, causing the dreaded "link" in the accident chain of events. I would like to review just a few of the more common human factors that we see involved in accidents in a little more detail.

Fatigue is one of the most common complaints that a physician hears about in the medical office. It has been mentioned as a factor in so many aviation accidents that the airlines have developed "counter fatigue" programs for their pilots. Fatigue's presentation, like hypoxemia, is usually insidious. Symptoms are not immediately recognizable, so the pilot must self-monitor.

Some of the symptoms of fatigue include: increased reaction time, channelized focus, fixation, short-term memory loss, impaired judgment, and poor decisions. The pilot may be easily distracted, have decreased visual perception, and overall sloppy flying. Fatigue's onset may be acute or chronic. Acute onset is typically benign and related to a recent event. Chronic fatigue is more serious and is associated with an increased risk of infections and increased vulnerability to adverse effects of stress. When fatigue is chronic, the pilot may experience a personality change, be irritable, and be short-

tempered with the flight crew. Chronic fatigue from lack of productive sleep can ultimately lead to depression.

Fatigue leads to a pronounced impairment of performance, decreased motivation, decreased alertness, and a tendency toward "micro sleep" with no awareness that you were asleep. Small errors and mistakes are exaggerated.

Many factors influence a pilot's ability to cope with fatigue's effects. One of the most logical factors is age. It would not be surprising to learn that a 25-year-old pilot will tolerate fatigue differently than a 58-year-old pilot. Heading west is easier and less fatiguing than heading east, as you are traveling with the sun. Also, it should be noted that a change in one's circadian rhythm causes the greatest chance for pilot error between 4:00am-6:00am on the pilot's home rhythm.

Diet may have an effect on fatigue as well. For example, a diet high in carbohydrate may have a sedative effect, whereas a high protein meal would have the opposite effect. If the goal is to stay awake, the pilot may do better with the high protein bar rather than the high carbohydrate candy bar.

Another human factor that affects performance and flight safety has to do with alcohol and tobacco use. Most pilots understand the adverse effects of hypoxia; however few pilots realize the association between hypoxia and smoking or alcohol use prior to flight. It has been shown that one ounce of alcohol translates into an added 2,000 feet of altitude if consumed prior to flying. This is known as the *physiologic altitude*, the altitude that the pilot "*feels*" like he is at.

Alcohol interferes with the ability of the cells in the body to use delivered oxygen. . In regards to alcohol and aviation accidents, a recent study has shown that pilots with DWI convictions were about 3.5 times more likely than pilots without convictions to have alcohol-related general aviation accidents. (DWI Convictions Linked to a Higher Risk of Alcohol-Related Aircraft Accidents Authors**:** K.L. McFadden Reference**:** *Human Factors*, 2002, Vol. 44, pp. 522-529). The "8hr bottle to throttle" is inadequate as far as the human physiology is concerned. The presence of any alcohol in the body may be detrimental to the pilot's performance.

In regards to nicotine, if a pilot were to smoke 3 cigarettes quickly or 20 cigarettes in the prior 24 hrs, their physiologic altitude would make it feel as if they were 3-5000ft higher altitude then they are. This is due to the adverse effect of carbon monoxide in the ability of hemoglobin to carry oxygen to the cells. The adverse effects of smoking have been well documented over the years. However, what about the pilot that is quitting tobacco use? Could there be any risk to flight safety, as far as symptoms of nicotine withdrawal?

A recent published study revealed that "abrupt cessation of smoking may be detrimental to flight safety and the smoking withdrawal syndrome may influence flying parameters".

(According to G. Giannakoulas, A. Katramadous, N. Melas, I. Diamantopoulos, and E. Chimonas in an article published by *Aviation, Space, and Environ. Medicine* 2003, Vol. 74, pp. 247-251 Acute Effects of Nicotine Withdrawal Syndrome in Pilots during Flight)

The above study revealed that "the most frequent symptoms reported during nicotine deprivation were nervousness, craving for tobacco, tension-anxiety, fatigue, difficulty in concentration, decrease in alertness, disorders of fine adjustments, prolonged reaction times, anger-irritability, drowsiness, increase in appetite, and impairment of judgment. Systolic BP and heart rate tended to decrease and diastolic BP tended to rise during withdrawal, although the differences were not statistically significant. Finally, all tests recorded an impairment of cognitive functions during abstinence". It is a great idea to quit smoking, but one must be aware of the symptoms of nicotine withdrawal and seek medical help if needed (caution- many medications to help with these symptoms are not FAA approved)

When it comes to medication, or more importantly "self-medication", one must consider that all medication have an effect (desired) and a side effect (usually un-desired). For example taking diphenhydramine (Benadryl) for allergies. This chemical is a very common ingredient found in a variety of allergy and cold meds. The use by a pilot is not permitted prior to flying as the adverse effects include significant drowsiness, dry mouth and dizziness.

There are numerous over the counter medications that would render the pilot un- fit for flight. Occasionally, medications are studied under driving conditions, and very rarely have been tested in the flight environment. When it comes to taking *any* medication as a pilot, the best advice would be to discuss it with your AME.

Even though the safety record of general aviation is improving over recent years the same accidents seem to occur year after year. These accidents include pilots that fly perfectly good airplanes into terrain (CFIT) due to lost situational awareness and of course pilots that succumb to disorientation when flying VFR into IMC. Unfortunately, poor decision making skills still exist when it comes to scud running, flying in poor weather and in reduced visibility.

If we are to decrease accidents in general aviation, it is absolutely necessary to better educate pilots in the physical limitations of the human component. General aviation safety may improve if we ask ourselves a few questions prior to flight. Is the airplane airworthy? Am I properly trained and current for this flight? Am I **physically fit** to fly today?